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The Safety Standard Smoke Screen

I know very well that to sound a false alarm is a shallow and contemptible thing. But I know, also, that too much precaution is safer than too little, and I believe that less than the utmost is too little now. Better, it is said, to be ridiculed for too much care than to be ruined by too confident a security.

—Rufus Choate

1

The American National Standards Institute (ANSI) has adopted a set of electromagnetic energy exposure levels that the Institute of Electrical and Electronic Engineers (IEEE) has determined to be safe for humans. The ANSI safety standard was initially developed during the 1960s modified during the early 1980s, and modified again, most recently, during the early 1990s.

One particularly important aspect of the guidelines is that portable cellular telephones were completely exempted from compliance, testing, or regulation of any kind.

In its initial form, during the 1960s the IEEE/ANSI safety standard, known as ANSI C95.1, established a

maximum safe exposure level for radiofrequency radiation at 10.0 mW/cm². The modified version of the standard, ANSI C95.1-1982, set the maximum level for radiofrequency exposure on a sliding scale. To find the maximum exposure level it is necessary to divide the frequency, in MHz, by 300. At 845 MHz the limit would be at about 2.8 mW/cm². However, the standard was again written to exclude portable transmitters from compliance. If it were not for the categorical exclusion that exempted portable cellular telephones from any radiation exposure regulations, the devices would have been barred from the marketplace as unsafe for humans.

But how does the standard setting committee really know what is and isn't safe for people?

Most people think that regulatory agencies, such as the Food and Drug Administration and the Environmental Protection Agency, are staffed with research experts who conduct experiments and evaluate the effects of products. Most think that these government agencies take a leading and active role in performing research and establishing the safe exposure standards. This is not true in most cases. Typically, these government agencies rely on the research community to produce findings that can be evaluated to determine regulatory action. And, as noted, the research community is comprised of industry researchers and independent researchers, many of whom are funded by industry grants.

This shortage of independent government research capability becomes quite evident in view of one industry researcher's observation that

with the current budget cut-backs, the agencies of the Government will not have the time, the funds and the personnel to research the particular exposure conditions of the mobile communications

transmitters. The Government agencies however, are receptive to and take into account well documented characterization of the exposure from some RF sources. It is up to the industry to show reasonable evidence of adherence to safety standards and receive categorical exclusions. [129]

Very early in the 1980s, Gandhi[130] advised that many countries, including Canada and Sweden, had abandoned the U.S. standard of 10 mW/cm² and were moving their safe exposure standard more toward that of the former USSR, which was 1,000 times lower (0.01mW/cm²) than the U.S. standard.

Any exposure limitation that relies on power density as the guide for limiting radiation ignores much of the research of enhancements and "hot spots" that has been made known during the 1970s. Our primary concerns now are with near-zone exposure to radiation. The planewave experiments and findings ignore the enhancement effects and nonuniform radiation absorption conditions that exist with transmitters close to the human head. In 1984 R. J. Spiegel wrote that

for humans exposed to electromagnetic (EM) radiation, the resulting thermophysiologic response is not well understood. Because it is unlikely that this information will be determined from quantitative experimentation it is necessary to develop theoretical models.[131]

[129] Q. Balzano, "Evolution of RF Safety Standards and Their Impact on Mobile and Portable Transmitters," IEEE (1986):26-31.

[130] Gandhi, O. P., "State of the Knowledge for Electromagnetic Absorbed Dose in Man and Animals," Proceedings of the IEEE, Vol. 68, No. 1, January 1980, Pp. 24-32

[131] R. J. Spiegel, "A Review of Numerical Models for Predicting the Energy Deposition and Resultant Thermal Response of Humans Exposed to Electromagnetic Fields," IEEE Transactions on Microwave Theory and Techniques MTT-32, no. 8 (August 1984):730-46.

That researcher was conceding the fact that research, using human test subjects, was unethical and would not be performed. Instead, as we already know, safety standards would be based on nonhuman effects and results—laboratory animal test results.

2

Some years ago concerns about radiofrequency radiation leaking out of microwave ovens was coupled with concerns for safety by some users of portable two-way radios. At that time, the late 1970s, there was also some concern among users of portable radios that the energy radiating from a transmitting antenna could cause tissue damage. Owners and operators of those two-way radios began making demands for research evidence that would "prove" the radios were safe.

In one effort to defuse concern, research experiments were performed and subsequently published in a technical journal of the Institute of Electrical and Electronic Engineers (IEEE). Instead of yielding test results that would disprove claims of hazardous exposure to radiation, the results proved exactly the opposite—electric fields close to radiating antennas were excessive. One would expect that with these facts in hand and published worldwide the manufacturers would become alarmed and move to a position of increased research and, perhaps, take steps to safeguard the health of their customers. Instead, in a bewildering leap of illogic the industry scientists proposed that the research findings were not a concern. They brazenly proposed that physical

principles should not apply in close proximity to radiating antennas.

Imagine: industry researchers had discovered that physical principles, which held true everywhere else in the universe, did not apply in close proximity to transmitting antennas! Having taken this bold leap, based on the published research of the industry's own research scientists, the manufacturers of portable and mobile transmitting communication devices then lobbied the IEEE/ANSI standard setting committee. The industry convinced the committee to exempt portable hand-held communications devices from the safe exposure limits of the safety standard. That is, portable radios and cell phones, were categorically exempt from compliance with maximum safe exposure limits.

Consider again that the industry's own research findings during the 1970s proved that there was excessive exposure to users of portable transmitting devices, so the manufacturers decided to throw out the laws of physics. They exempted themselves from the laws of the universe in order to continue to market their products to the unsuspecting public.

The industry research clearly shows the industry's economic concern by stating that

> ***if safety standards of independent and government agencies do not take into account the peculiar nature ofthe electromagnetic energy in the close vicinity of some radiating devices, it is conceivable that the power of portable two-way communication equipment might be forced down to useless levels.***[132]

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[132] Q. Balzano, "The Near Field of Omnidirectional Helical Antennas," IEEE Transactions on Vehicular Technology VT-31, no. 4 (November 1982):173-85.

They suggest that electromagnetics in the near-zone of antennas is somehow different than elsewhere in the universe. Their proposition is that, since they don't quite understand the physics relating the electromagnetic fields to the near-zone of antennas, safety standards should not be enforced because it would be detrimental to the industry.

Those researchers found that exposure to some antennas yields a power density of as much as 127 mW/cm^2 when the antenna is placed about 1 cm distant. The radiated power was only 0.02 watts. That's thirty times less than radiated from a portable cellular telephone. Yet the power density from such a low-power device was about fifty times higher than safety standards would allow. The researchers further observed that

this last value should be considered extremely dangerous biologically; yet, in the near field of an antenna, such apparent power densities are reached with only 20mW of radiated power.

Clearly, they comprehended the danger that their own research findings were yielding. They concluded that in order to meet the safety standard, the antenna that they employed could radiate no more than 0.00025 watts. That's 2,400 times lower than portable cellular telephones are allowed to emit.

3

Throughout the 1980s industry researchers continued their opposition to the proposed lowering of allowable exposure levels. They provided great insight into the thinking of the industry's lobbying tactics and interests. By

lowering of exposure limits it is meant that the allowable maximum of exposure to radiofrequency radiation was to be reduced. One industry lobbyist posed an argument in reverse logic by proposing that

> ***the old (repealed) OSHA standard level of 10mW/cm² was sufficiently high to require only relatively few precautions to ensure the safety of the workers of the land mobile industry.***

Clearly, the industry confuses compliance with a standard as ensuring safety. The researchers added:

From the above considerations it should be clear that the possibility of product liability, personal injury and negligence law suits increases with falling EME human exposure protection guides. The manufacturers of mobile and portable transmitters seem to be condemned to severe limitations in antenna installation and RF radiated power, if they want to avoid some legal consequences of the falling exposure limits.[133]

Again, the industry researchers note, in the article that was directed as a warning to manufacturers and service providers, that stricter safety guidelines will lead to increased legal problems. Never does it mention that there is a concern for the health of human operators or customers who buy the products. Industry researchers and industry-sponsored researchers had already, consistently, determined that the radiofrequency radiation to which users are exposed is dangerous.

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[133] Q. Balzano, "Evolution of RF Safety Standards and Their Impact on Mobile and Portable Transmitters," IEEE, 1986, pp. 26-31.

During research and experiments some of those same researchers have cautioned that the near-zone of radiating antennas is particularly dangerous because of the nonuniform radiating characteristics of portable antennas and because of the added presence of the energy stored around the antenna.

Nevertheless, they choose to ignore the research, some of it their own, and misrepresent the state of research in saying that

> ***all existing or proposed U.S. standards for safety of human exposure to RF EME have very poorly defined the near field and the partial body exposure conditions. These areas have not been researched extensively and much work remains to be done to complete this task. . . (see footnote 133)***

This is undisputably incorrect. Industry scientists and others have performed substantial research that demonstrates: (1) near-zone radiation "hot spots"; (2) near-zone measurements that confirm high energy in the vicinity of the antenna; (3) radiation absorption "hot spots" in the human head; (4) efficient radiation absorption into the human head from near-zone transmit antennas; (5) that the radiation levels emitted by portable cellular telephones cannot meet any IEEE/AN SI safety standard provision (which is why they have been exempted from compliance); and (6) that to meet the safety standards the power levels of some of the portables would need to be reduced by more than a factor of 1,000.

Industry researchers by 1986 must have realized that something was happening as a result of radiofrequency radiation exposure. Even at that time some standards were being reevaluated with a downward revision in mind.

Exposure standards currently recommended by international health organizations and under consideration by U.S. Government Agencies restrict the occupational exposure to 500 μW/cm² and the environmental (general public) limit to 200μW/cm² in the band of land mobile frequencies (see footnote [133]).

This continual lowering of the maximum allowable radiation exposure had to be supported by documented research. Also, the continual reduction of the maximum radiation exposure levels had to, take place in an environment where industry lobbied heavily against the reductions. Most probably the safe exposure levels would have been proposed at much lower levels, as are the USSR standards, if not for pressure by the industry and military interests.

In an article that speaks of problems associated with the setting of safe exposure levels, Gandhi wrote that IEEE/ANSI safety standards are based on behavioral effects of laboratory animals. In order to establish a dangerous level of exposure an observable disruption of behavior must be documented.

In the absence of verified reports of injury or adverse effects on the health of human beings who have been exposed to RF electromagnetic (EM) fields, the ANSI standard was based on the most sensitive measure of biological effects—the behavioral effects on laboratory animals.134

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134 O. P. Gandhi, "The ANSI Radio Frequency Safety Standard: Its Rationale and Some Problems," IEEE Engineering in Medicine and Biology Magazine, March 1987, pp. 22-25.

Imagine—the basis of the maximum safe exposure for humans is whether or not laboratory animals are observed to be adversely affected when exposed. Of more concern is the manner in which disruption of behavior was measured. Some researchers have documented that they did not count disruption until the laboratory animals had nearly ceased all activity.

The example detailed earlier, of observed behavior disruption in laboratory rats, underscores the point vividly. Even though the rats were exhibiting clear signs of behavior modification, the effects were not considered until the animal had a decrease of activity by 67 percent. Researchers then arbitrarily determined that if the laboratory animals resumed normal activity after the radiation ceased the long—term effects were not to be considered.

Let's take another look at the brickmason of a previous example. Assume that the bricklayer can usually lay 100 bricks each hour - all day long. However, for this experiment the bricklayer is exposed to radiofrequency radiation. As the level of radiation is increased the bricklayer begins to lay bricks more slowly. First, only 80 bricks an hour; then 50, and finally only 33. Recall that the bricklayer was able to consistently lay one hundred bricks hour after hour without let—up, but during exposure to the radiofrequency energy he continuously slowed as the radiation level was increased. Now wouldn't it make sense to notice something happening to this man when he slowed to 80 bricks an hour or even 50 bricks an hour? At 33 bricks per hour he is nearly incapacitated. But, according to the biological effects researchers that is the detection point. They would have the threshold level for observable effects set at the point where the bricklayer was only laying 33 bricks an hour.

What would they set the threshold level to for someone operating an automobile? What about a surgeon just prior to performing a difficult operation?

Gandhi writes that behavioral disruptions have been observed at 4 mW/g. However, other researchers have documented behavioral disruptions at much lower levels - less than 1 mW/g. Our earlier review of the *Scientific American* article discussed a group of such research findings at 0.1mW/g. That article also points out the concern related to "the highly nonuniform nature of SAR distribution, including some regions where there may be fairly high local SARs."[135]

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There are also research findings that have shown that exposure to radiofrequency radiation causes damage to the DNA structure of brain cells. This is a dramatic revelation, as the cellular telephone industry has maintained that no harmful mechanism could be identified because it was not possible to cause DNA modifications at radiofrequencies. Now we have research reports coming from the United States, Sweden, India, Belgium, Croatia, and Germany, with others no doubt to follow, which conclude that radiofrequency exposure does cause DNA damage.

While the telecommunications industry spokesmen publicly argued that their research proves such effects are impossible, the industry's own researchers made it clear that the industry hadn't even developed the skills to perform the necessary testing.

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[135] *K. R. Foster and A. W. Guy, "The Microwave Problem," Scientific American, 255, no. 3 (September 1980) 32-39.*

Their researchers stated that

the study of the near field has been substantially neglected.

How then can we accept the cellular industry representations of proven safety, made to the standard setting committee, when it concedes that it has neglected to perform the research? As we pointed out earlier, those industry researchers admit that

"dipole antennas, although extensively used in portable and mobile communications, have not been carefully investigated in the near field."[136]

This admission clearly indicates a lack of concern on the part of the portable communications industry as it continued with product development—Without the supporting biological effects research. It would be reasonable to presume that extensive research had been performed to provide some confidence that the devices were not dangerous. That is what the industry has been stating publicly. Instead we learn from industry engineers and scientists that very little research was conducted up to that time.

We also see how industry researchers tied their experimental results to the lobbying effort that would exempt portable products from the safety standards.

The proposed standard recognizes the possibility of encountering fields higher than the maxima of the

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136 *Q. Balzano et al., "Energy Deposition in Simulated Human Operators of 800-MHz Portable Transmitters," IEEE Transactions on Vehicular Technology, VT—27, no. 4 (November 1978):174-181.*

Protection Guides in the close vicinity of low power radiators, like portable communication equipment. For this reason, an exclusion clause for devices operating at 1 GHz or less and with less than 7 W out-put power has been proposed" (see footnote 136).

They have clearly stated that since the safety standard cannot be met by portable hand-held transmitters; such transmitters, portable radios and portable cellular telephones for example, should be exempt.

They continue by verifying that portable transmitter products cannot meet the safety standards. The researchers state that

the Radio Frequency Protection Guides of the American National Standards Institute at 750MHz would be violated at 0.3 cm distance by a resonant dipole radiating about 1mW and at 0.5 cm distance by a radiated power of 4mW (see footnote 136).

Interestingly, a "resonant dipole" provides the most favorable condition of minimum stored energy around the antenna. For antennas of different configuration, the stored energy is many times larger. This would force the allowed radiated power level to much lower levels in order to comply with safe exposure requirements.

The researchers themselves concede that

A rigorous enforcement without exclusion of the Radio Frequency Protection Guides would render portable radios practically useless.

Strict enforcement . . . technically forbids the exposure to a resonant dipole about 19cm long, radiating 1mW. . . (see footnote 136).

Having examined their own data, these researchers conclude that in order to meet the requirements of the proposed ANSI safety standard the power from a transmitter would need to be reduced to less than 1.0 mW. That means as long ago as 1981 industry research confirmed that the transmit power level from portable cellular telephones was about six hundred times higher than the ANSI safety standards would allow. Their solution to the dangerous radiation exposure problem: exempt the portables from the safety standard.

At the outset the industry researchers established their purpose by stating,

> ***This paper addresses the question of how low the power radiated by a dipole has to be so that the field near the antenna never exceeds the ANSI-proposed protection guides for distances greater than 0.3cm, which is the spacing that at times separates the antenna from the head of a portable radio user .... [A] radiated power of a few milliwatts is enough to exceed the proposed radiation protection guides at 750MHz .... [S]uch reticence in accepting the clause probably resides in the fact that the near field of antennas is largely uninvestigated.***[137]

The experimental data, presented in graphical form, clearly demonstrate nonuniform electric field intensity in the near—zone of the radiating antenna. The significance of that disclosure is to confirm the concept of nonuniform near—zone radiation and energy. But these scientific revelations couldn't deter an industry that exists solely by

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[137] *Q. Balzano, et al., "The Near Field of Dipole Antennas, Part 1: Theory," IEEE Transactions on Vehicular Technology, Vol. VT-30, no. 4, (November 1981) 161-174.*

product development and sales. A problem of this magnitude needed to be dealt with or else the notion of portable transceivers was dead. And the problem was dealt with—by suppression.

5

The cellular telephone industry spokesmen would like to argue that there is no proof that operating a portable cellular telephone while driving an automobile has led to an increase in traffic deaths. This is a very narrow measuring stick to use in its argument, for we know that most cellular telephone calls are not performed on the freeways at high speed. Most calls are made within cities and suburban areas where traffic incidents are likely to be less severe and result primarily in property damage and personal injury but less often death. The diminished motor skills of drivers are more likely to show up in these accidents and also in accidents where the cellular telephone user is an uninvolved contributor, due to erratic driving, who simply drives away from the scene and leaves the damage behind.

The 1986 Scientific American article that carried the "correction" of Guy and Foster provided additional graphical data related to the IEEE/ANSI safe exposure setting process.[138] The safe exposure level is supposedly set to be ten times lower than the level at which behavioral or biological effects have been observed in laboratory animals. That SAR is set at a level of 0.4 mW/g. The graphical data of reported behavioral and biological effects show

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[138] *K. R. Foster and A. W. Guy, "The Microwave Problem," Scientific American 255, no. 3 (September 1986):32-39.*